d·432. 8532a

MESOLABIVM ARCHITECTONICVM

~~531.l.10~~

THAT IS,

A moſt rare, and ſingular Inſtrument, for
the eaſie, ſpeedy, and moſt certaine mea-
ſuring of Plaines and Solids
by the foote:

Neceſſary to be knowne of all men whatſoeuer,
who would not in this caſe be notably
defrauded:

7 K

Inuented long ſince by *Mr. Thomas*
Bedwell Eſquire:

And now publiſhed, and the Vſe thereof decla-
red by *Wilhelm Bedwell*, his nephew,
Vicar of Tottenham.

LONDON,
Printed by *I. N.* for *VVilliam Ga*
1631.

TO THE ILLVSTRIOVS,

Right-honourable, Right-worſhipfull, and dearely beloued, the Nobility, Gentry, and Commons of *Great Britaine*, and *Ireland*.

God, ſayth the wiſe man, hath ordered all things by meaſure, number, and weight. And man, the image of God, ought, as the Philoſophers teach, to order all his life according to the ſame directions. And yet who knowth not, how little they are of all men regarded! To paſſe by the generall, and to come to that which concerneth our commerce, What ſmatterer in the Mathematicks is hee, who knoweth not, what neglect or ignorance there is, euen in thoſe artiſts, whom all men, the Rich aſwell as the Poore, do, and muſt daily truſt, in matters of meaſuring! I accuſe no man of wilfull fraude or malice. But this I ſay, There is no man whatſoeuer, that is not ſome peece of a ſcholler, that can meaſure tymber truely: And thoſe who are moſt skil-

full in both, cannot do it either ſpeedily, or readily. All which, Illuſtrious, Righthonourable, Right-worſhipfull, and Dearely beloued, I promiſe in this ſhort treatiſe, by the ordinary Inſtrument, in this caſe vſed, to teach the meaneſt of vnderſtanding, though wholy vnlearned, to do, with that ſpeede, facillity, and certainety, that may not be bettered. This as a prodromus, begun and ended, in the middeſt of many and great troubles, J thought good to premiſe and ſend out, before a larger diſcourſe of the Fabricke, and more ample Vſe thereof, which, God willing, ſhall follow, ſo ſoone as Figures and Diagrammes may conueniently be cut, for that purpoſe, with all poſſible ſpeed: In the meane time the Author, wholy deuoted to his Countries ſeruice, reſteth

Your H.H.H. in all obſeruancy,

Wilhelm Bedwell.

MESOLABIVM ARCHITECTONICVM.

CHAP. I.

Of the Meſolabe: And of the vſe of it in generall.

1 To meaſure by this Rule, is by two knowne lines, to finde out the third vnknowne.

THe Inſtrument whoſe vſe at this time wee intend to declare, is no other, in reſpect of matter and forme, in generall, but the Carpentars rule, by them vſed in the meaſuring of Tymber, and Bourd by the Foot ſquare: For it is a flat Ruler, or oblong parallelogram, of two foote, or a foot & halfe long: Two inches and an halfe, or there abouts, broad: And of ſuch convenient thickneſſe as ſhall at euery mans diſcreſion be thought moſt fit.

Againe, as theirs, ſo this on the one ſide, contayneth a Scale of equall diuiſions, Firſt of Ynches, Halfe-ynches, Quarters, Halfe quarters, and ſo forth: Then againe, on the ſame ſide, you haue an Ynche diuided into Seauen, Eleuen, Thirteene, Seauenteene, Nineteene, and Three and twenty, and ſuch other equall parts, as euery man for his owne vſe ſhall think moſt fitte, and the workmans hand ſhall be able to performe.

Moreouer, on the other ſide, as on theirs alſo, you haue a Scale of vnequall diuiſions, ſeruing for the meaſuring of Bourd and Tymber: But after a farre different manner: For their diuiſions are only markes or ſmall ſtrokes, in one of the limbs of that ſide, determinyng from the Fore-end of the Rular in ynches, and partes of ynches, the Square meaſure of ſolids or Tymber. Wheras this of ours conſiſteth of two ſortes of ſtraight lines, the one Beuelling or Slanting, drawne askue from ſide to ſide: The other Parallell that is equidiſtant one from another running along the Rular, from the one end toward the other: And therefore cutting thoſe former, and diuiding them into vnequall portions, whereby not onely their ſayd *Q*uadrate or ſquare meaſure is performed: But alſo all other whatſoeuer, and that with great facillity, ſpeede, and certainety.

Laſtly here, as alſo there, you muſt make a diſtinction betweene end, and end; For that end we call the For-end of the Rular, from whence the diuiſions of it into ynches, on both ſides are begun to be reckoned: And that the Backer-end where they doe end and determine: Or, contrarywiſe, the For-end is that from whence the numbers aſſcribed to the Beuelling linnes are leſſe and leſſe. But the diſtances betweene them are greater and greater.

Thus much of the Ruler, and the Partes therof. *Menſura, innuit Ariſtoteles, in quolibet menſurabili genere, eſt quippiam minimum*: A meaſure, as Ariſtotle ſeemeth to intimate, is ſome ſmall portion in euery thing that is to be meaſured: And it is commonly termed of the Geometricians *Famoſa menſura*: A knowne, or ſet meaſure generally agreed vpon amongſt all men: As in meaſuring by hand-breadths, feete, and paſſes, one hand breadth, on foot, one paſſe. And in deed it is an old ſaying of *Protagoras*, as Ariſtotle recordeth, *That man is the meaſure of all things*. And true it is, That Vitruuius, and Hero the mechanicke or inginer, do ſhew, That generally all meaſures are taken from tho partes of Mans body, as a Finger, an Ynch (*Pollex*) an Hand, or Hands breadth, a Spanne, a Foot, a Cubite, a Paſſe, an Elne, a Fathome.

But who knoweth not, What great difference there is between man & man? And not only between men of diuerſe Countreys and climats: But eu'n between thoſe of one and the ſame prouince; Nay of one and the ſame family, children of the ſame parents? And, the limmes of men being proportionall to their bodys, what difference muſt there needs bee, betweene the meaſures taken from them? And in deed heerupon it came to paſſe, That the Meaſures, not only of diuerſe Nations: But eu'n of one and the ſame, are, and alwayes haue beene much different, as doth manifeſtly appeare by the diligent compariſons made of them by diuerſe and ſundry learned men, and eſpecially by that hopefull Willebrordus Snellius, as wee ſhall, God willing, ſhortly teach in Ramus's Geometry, which wee purpoſe to ſet out in Engliſh, for the benefite of ſuch of our Countrey men, as delight in theſe ſtudy's, yet are ignorant of thoſe languages where in they are written.

This difference was in this our kingdome complained of in all ages: For from hence aroſe many greeuous quarrells and ſuites in the Law, which our worthy Kings, and ſtate in their Parlaments, in all ages haue laboured to appeaſe, by reducing all to an vniformity: For thus wee finde in our Statutes: *It is ordeined, That 3 grains of* Barley, *dry and round, do make* an Ynche: *Twelue ynches do make* a Foot: T*hree foote do make* a Yard: *Fiue yards and halfe do make* a Perch. *And 40 perches in length, and 4 in Breadth do make* an Aker. 33 of Edward the firſt, *De Terris menſurandis* Item, *De Compoſitione vlnarum et Perticarum.* Againe in a Perlament held in the 25th of Queene Elizabeth, you haue an Act, thus intituled: An Act for the reſtrainte of New-buildings, &c. in & nere the citys of London & Weſtminſter *Be it enacted by the authority afor'ſaid,* That a Mile *ſhall be taken & reckoned in this manner, & no otherwiſe:* That *is to ſay,* a Mile *to containe* 8 *Furlongs. And euery* Furlong *to containe* 40 *lugges or poales: And euery* Lugge *or Poale, to containe* 16 *foot and an halfe.*

Although this ſame our Rule may bee fitted for ſundry other ſortes of meaſures: Yet we haue here nothing to do, But with the Foote, and his partes, which are Ynches, Halfe-ynches, *Q*uarters, Half-quarters, and ſuch other ſenſible partes of the ſame.

2 Things to bee meaſured by this Rule, are magnitudes.

3 A magnitude is a continuall quantity.

A magnitude, or a bigneſſe is that which hath one, or more dimenſions: Now dimenſions are in number three, to weet Length, Breadth, and Thickneſſe.

4 A magnitude is of one dimenſion, or many.

5 The meaſure is of the ſame nature with the thing to be meaſured.

6 A magnitude of one dimenſion is called a Line.

A line, is a magnitude of length onely. Or, A line is a magnitude onely long. Such are wayes, or diſtances betweene place and place. Such a magnitude, ſayth Proclus out of Apollonius, is conceiued in the meaſuring of iourneys. And by the difference of a lightſome place, from a darkſome. Such are Lenghts, Heighths, Depths, and Breadths. Therfore here

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Here therefore there is no further skill required in the meaſurer then a due application of the meaſure giuen: And therefore here in this caſe there is not any vſe of this our Inſtrument.

CHAP. II.

Of the meaſuring of Plaines by the foot ſquare.

1 A magnitude of many dimenſions, is of two or three: That is called a Surface: This a Solid.

2 If a dimenſion giuen, be eyther greater, or leſſer, then any of the numbers vpon the Rular, you muſt take ſome leſſer, or greater.

which is proportionall vnto it.

3 A ſurface is a magnitude long and broad.

That is, a ſurface is a magnitude which hath two dimenſions,to weet Length and Breadth. Such magnitudes,ſayth Apollonius, are the ſhadowes vpon the ground, which ouerſpread the fields farre and wide,but do not enter into, or pierce the earth: Neither haue they any thicknes at all. The Greek woord *Epiphania*, is here more ſignificant. For this worde intimateth no more but, The outward appearance of any thing. For of a magnitude nothing is to be ſeene but the ſurface. Such are bourds eſteemed to be by the Carpentars: Wainſcotte, by the Ioyners: Glaſſe, by the Glaſiers: Cloth, both linnen & Woollen, by the Drapers: Land, Medowe, & Wood, by the Surueighers: For in the meaſuring of theſe, there is only Breadth & Length conſidered, with out any reſpect at all had to the Thickneſſe. Therfore

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Surfaces,according to their diuerſe natures,are meaſured with diuerſe and ſundry kindes of meaſures: Wood, Land, & Medowe, are meaſured by the Rod or Perch: Cloth,Painting,Pauing,& Wainſcotte, by the Yard: Bourd and Stone, by the Foote. Although this our Inſtrument may be fitted to all theſe,or any other like meaſure, Yet wee at this time intend to meddle with no other but the laſt, to weet With the Footeſquare.

4 A ſurface is either Plaine or Vneu'n.

5 A Plaine ſurface is a ſurface, which lyeth equally between his bounds.

A ſurface, the learned knowe is geometrically made of Lines: Therfore as lines are either ſtraight or Crooked: So from hence are all ſurfaces Straight or Crooked: Or, to ſpeak more properly, Eu'n or vneu'n, Plaine or Rugged: Yea & by a ſtraight line are ſurfaces tried, whether they be Eu'n, or vneu'n. For if a right line applyed to a ſurface euery way, do touch it in all places, it is Eu'n: Otherwiſe, it is vneu'n.

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9 Plaines, as wee ſayd, are meaſured by the Foote ſquare, That is the quadrate of 12 ynches.

A ſoote of plaine or flatte meaſure is the quadrate of 12 ynches, or that which is equall vnto it. That is, it containeth 144 ſquare Ynches: For 12 times 12, are 144. Hauing therefore a plaine giuen of 12 ynches broad, there is no queſtion but 12 ynches of that breadth ſhall make a Foote. But if the breadth giuen be greater or leſſe then 12, there is a queſtion, What length, with the breadth giuen, ſhall make a plaine equall to the ſquare 144. Here

7 Of the two lines giuen, the one is the breadth aſſigned, the other is alwayes the beuelling line 12.

Here againe it muſt bee remembred, *That onely thoſe plaines are to be meaſured which are Rightangled parallelogramms*, Or to ſpeake in their owne Language, which are comprehended of a, Baſe, and Heigh which are rationall betweene themſelues: Ramus 9 e IIII. Thoſe plains therfore which are not ſuch, muſt bee reduced vnto theſe kinde of figures.

1 An example or two ſhall make all plaine. A bourd of 16 ynches broad and 18 ynches long, (And ſo a ſtocke of 13 bourds) is to be meaſured. Here I finde 16, the line anſwering to the Bredth, to croſſe the beueller 12, at 9 ynches from the fore-end of the Rular. Therefore I ſay euery 9 ynches of that length ſhall make a Foot of bourd: Or which is all one, ſhall be equall to 144, the ſquare of 12 ynches. Now 9 ynches I finde to bee contained in 18 foote, the Length, 24 times: Therefore I ſay, The bourd aſſigned doth containe 24 foote of bourd. Laſtly, there being in the ſtocke 13 ſuch bourds, I ſay the whole ſtocke doth contayne 312 foot of bourd.

II A Table of 36 ynches broad, and 28 foote long, is to be meaſured. Here 36 is greater then any of the parallels found vpon the Rular: Therefore by the 2 e of this, I take 18 the halfe of it, which I finde to meete with 12, the beueling line, at 8 ynches from the for'end of the Rular: Therefore euery 8 ynches of length, of the bredth 18, ſhall contayne a foote of bourd: But the breadth giuen is 36 ynches: That is twice 18: Therefore euery 8 ynches in length, of that Table ſhall be 2 foote of bourd. Now againe I finde 8 ynches, in 28 foote 42 times: Therefore the Table containeth twice ſo many foot: That is 84 foote of board.

III A pane of Glaſſe, 7 ynches broad, is to bee meaſured. Here 7 is leſſer then any of the parallels: Therefore by the 2 e of this, I take 14, the double thereof: Which I obſerue to meete with 12, at 10 ynches and 2 ſeauenth parts of an ynch from the fore-end: Therefore euery 10 ynches and 2 ſeauenth partes of an ynch, of 14 ynches breadth, ſhall bee a foote of Glaſſe: But the breadth giuen is but 7 ynches: Therefore euery 10 ynches, and 2 ſeauenth partes of an ynch ſhall be but halfe a foote of glaſſe.

Of the meaſuring of Triangles, and all other Rightlined plaines.

8 A triangle is nothing elſe but the halfe of a quadrangle, or parallelogramme: And if it haue one right angle, it is the halfe of a rightangled parallelgramme. *Therefore*

9 It is to bee meaſured as the Rightangled-parallelogramme, onely conceiue that the number found, ſhall bee the double of that which is ſought.

Here therefore it muſt bee conceiued, That of the two ſides encluding the Rightangle, the one is to be vnderſtood to be the Breadth, the other the Length.

I Suppoſe a Rightangled-triangle, whoſe ſides including the Right-angle, are 18, and 24, are to bee meaſured. Here I take 18 for the Heighth, or Breadth of the parallelogramme. which alſo I finde to meete with the beuelling line 12, preciſly at 6 ynches from the fore end of the Ruler: Againe 6, the ſayd line found, I finde iuſt 4 times in 24 the Lenghth giuen: Therfore I auerre the Triangle giuen to conteine the halfe of 4 foote, that is 2 foote of bourd.

20 If the triangle giuen bee not right-angled, then is it by a perpendicular, let fall within the triangle, from one of the corners vnto the baſe, to bee reduced vnto two rightangled triangles.

How this is to be done, *Euclide* teacheth at the 11 & 12 propoſitions of his I, booke; And P. Ramus, at the 9 & 10 elements of his V. booke of Geometry. It is alſo to bee done by the ſquire. Or by a triangled leuell, and otherwiſe.

11 An Obtuſangled triangle, whoſe three ſides are 25 40, and 42, is to bee meaſured. Heere by one of thoſe aboue named wayes., I finde the perpendicular or plumbline, falling from the greater corner, vnto the oppoſite line, to be 24. And 24 I finde vpon the Ruler to meete with the line of 12, at 6 ynches from the fore-end of the ſame: Againe 6 I find in 42 ſeauen times: Therefore the Triangle giuen doth conteine halfe ſo many foote, That is 3 foote and an halfe of bourd.

11 From hence it is manifeſt how any Rhombus, Rhomboides, Trapezium, or irregular rightlined multangles are to bee meaſured.

To weet, that they are to be meaſured by parts, or by the particular triangles, which euery ſuch figure doth contayne. Examples you may haue in the XIIII booke of Ramus's Geometry, or in any others, which haue written of Geometry.

Of the meaſuring of any ordinate multangle figured.

12 Ordinate multangled plaines are meaſured

by their halfe Perimeter, and the plumbline from the center, vnto the middeſt of any one ſide.

Theſe ſortes of plaines may bee meaſured, as the former were, by diuiding them into their ſeuerall Triangles. But this laſt is farre ſhorter: And therefore to bee embraced & rather to be vſed in practiſe. Here the halfe of the perimeter, or bout-line, anſwereth to the Length in a parallelogramme: And the plumbline here, is in ſtead of the Heighth or Breadth there.

I An ordinate Pentangle, whoſe ſides are 24 ynches a piece; And the Plumbline from the center, to the middeſt of any one of the ſides 16, is to be meaſured. Here 16 the Plumbline or Heighth, doth, vpon the Rular, meet with the ſlanting line 12, at 9 ynches from the oft named end: And 9 is contayned in 60, the halfe of the perimeter, 6 times and two thirds: Therefore the Pentangle giuen conteineth 6 foot, and two third partes of a foot of Bourd.

II A Sexangled ordinate figure, whoſe ſides are 12 ynches broad a piece, is to bee meaſured. Here the Plumbline from the center to the middeſt of any one ſide, is 10 ynches, and 8 one and twentyths of an ynch: The double of 10 (that is 20.) and 16, one & twenty parts of one ynche, I obſerue to meete with the beueller 12, about 7 ynches, & one quarter of an ynch, from the fore end of the Rular. Which 7 and a quarter, is contained in 44 ſix time, and two twenty nineth partes. Therfore I ſay the Sexangled figure giuen doth containe 6 foote of bourd, and ſome ſmall quantity more. The Circle, or Circular forme is in like manner meaſured: For

13 The Circle is meaſured by the Ray, and the halfe of the perimeter.

For, ſayth the Geometrician; *Planus è radio & peripheria dimidio eſt area circuli.* The plaine of the ray, and halfe of the circumference is the content of the circle. A Round table, whoſe diameter is 4 foote, and 8 ynches, (or 56 ynches) is to be meaſured. The halfe of 59 is 28: And the halfe of the circumference is 88. Now 28 being geater then any of the paralells, I take 14 the half therof Which I find to meet with the beuelling line 12, at 10 ynches, and a quarter, from the for'end of the Rular: Therfore I ſay euery 10 ynches, and a quarter of an ynche of that Table ſhall be 2 foot of bourd. And becauſe 88 doth containe 10 and 1 quarter, 8 times, and 20 fourty ones; Therefore I ſay, the whole doth containe 16 foot of of bourd, and 144 ynches.

CHAP. III.

Of the meaſuring of Bodies or Solids by the Foot.

1 A Body is a magnitude of three dimenſions. A Body or Solid is a magnitude which hath Length, Breadth, and Thicknes.

2 Here the meaſure is alſo a body, to weet the Cube of 12 that is 1728.

This is our opinion: Yet if any ſhall thinke it a paradox, or ſhall gaine ſay it, or mainetaine the contrary, wee will not contend. And

3 Of the three dimenſions, two are giuen, the third is ſought.

4 Bodies are of diuerſe ſorts: But we will at this time meddle only with ſuch as are comprehended of parallelogrammes, or with Cylinders.

True it is, that this our inſtrument may bee fitted, and applyed to the meaſuring of many other ſorts of Solid bodies: But becauſe we ſee no great vſe of it in the meaſuring of any other, then of theſe two ſorts: Therefore wee will declare the vſe of it, in the meaſuring of theſe two onely. Of theſe the firſt is the Parallelepipedum, which is a plaine Solid, whoſe oppoſite ſides are parallelogramme.

I A rightangled parallelepipedum (or a ſquared tymber logge) of 12 Ynches thicke, 18 broad, and 16 foote long, is to be meaſured. Here the Thickneſſe and Breadth are giuen: The Length is ſought. Theſe I finde vpon the Rular to meet at 8 ynches from the oft named fore-end: Therfore I Say, Euery 8 ynches of that Logge in length ſhall make a ſolid foote of tymber. And becauſe I finde 8 Ynches, in 16 foote, 24 times: Therfore I ſay in the Tymberſticke giuen, there is 24 foote of ſolid meaſure.

II A ſquared ſtone of 14 Ynches thicke, fiue foote (or 60 ynches) broad, and 10 foote long, is to be meaſured. Here 60 is greater then any of the parallels vpon the Rular: Therfore I take 12 the 5th part of it: And I obſerue 12 and 14, to meete at 10 ynches, and 2 ſeaunth partes of an ynche, from the Fore-end of the Rular. Therfore I ſay, That euery 10 ynches, and 2 ſeaunth partes of an ynch in length of that ſtone ſhall be 5 foote of ſolid meaſure. And becauſe that 10 foote conteineth 10 ynches, and 2 ſeaunth parts of an ynche, 11 times and 5 ſeauenty twoos: Therfore I ſay the whole ſtone conteineth 58 foote, and one third parte of a Foote of ſolid meaſure.

III A rightangled Priſma, both whoſe ſids, Parallelogramm
I meane, conteyning the rightangle, are 18 ynches br
the whole being in length 16 foot, is to be meaſure
vnderſtand that, as before was ſhewed, as a Triangle was but the halfe of a quadrangle: So a Priſma is nought but the halfe of a Parallelepipedum, ſawne longways from corner to corner though the midd'ſt: And hence in Greek it hath the name: This knowne I enter with the numbers giu'n, and I finde 18 to meet with 18, at 5 ynches and one third parte of an ynche from the oft named end of the Rular: Therefore I ſay, That euery 5 ynches, and 1 third parte of an ynche in length of that ſticke ſhall be but halfe a foote of ſolid meaſure. Nowe becauſe 5 ynches, and 1 third of an ynche is conteined in 16 foote, 67 tymes and 14 ſixteen partes, that is almoſt 68 times: Therfore I ſay, The Priſma

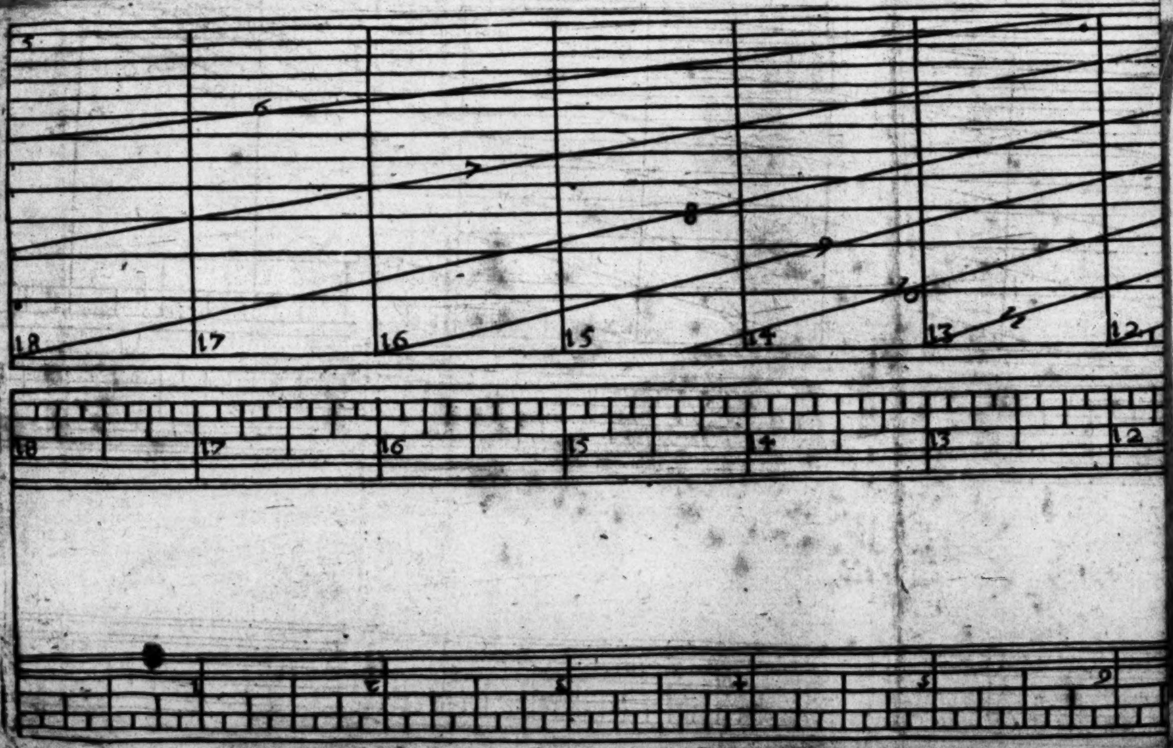
giu'n doth conteine almoſt 68 halfe foot's, or 34 foote of ſolid meaſure.

IIII A ſiſpaned ſolid, all whole ſides are 6 ynches broad a peece and 16 foote long, is to bee meaſured. Here the two lines giuen are, as aboue was taught, the Plumbline from the center, vnto the middeſt of any one of the ſides: And the halfe of the compaſſe; That, as before was taught, is 5 ynches, and 2 eleuenth partes of an ynche: This is, as you ſee 18. Now 5 and 2 eleu'nths doth meet with 18, at 19 ynches and 1 fifth parte of an inche from the fore-end: Therfore I ſay, That euery 19 ynches, and one fifth parte of an ynch, ſhall be a foote of ſolid meaſure. Laſtly, becauſe 16 ynches, and 1 fifth parte is conteined in 16 foot, 10 times, and 2 fifteene pates, I ſay that the tymber ſticke giu'n doth containe 10 foot of ſolid meaſure, and ſome ſmall quantity more.

Laſtly a Round columne, or Cylinder, of 44 ynches about, & 12 foote long, is to be meaſured. Here according to that aboue taught, the two lines giu'n are, The half diameter, & the halfe circumference: This is 22: That 7. Now theſe two
do meete vpon the Rular at 11 ynches, and 17 ſea-
uenty two partes, of an ynch, from the
fore-end there of; Therefore the
ſticke containeth about 13
foot of tymber or ſolid
meaſure.

⁂

FINIS.



AN APPENDIX TO THE MESOLABIVM.

TWo things, for the further illuſtration of the Inſtrument, wee haue thought good here to annex vnto the former. The one is a collation of this manner of meaſuring, with th commonly taught and practiſed. The is of the Meaſuring of Land by the Al

A foot of ſolid meaſure, as all doe generally kn Cube of 12 ynches; that is, a ſquare, or dye-for y, all whoſe dimenſions, to wit, Thickneſſe, Breadth, and Length are equall: And the content, in numbers, is found by a continuall multiplication of 12, 12 and 12, thus: 12 times 12, are 144: and 12 times 144, are 1728. Therefore a foot of ſolid meaſure doth conteine 1728 ſeuerall cubes of an ynch, thickneſſe, breadth, and height. This is as it were the ſtandard, whereby this kinde of meaſuring is to be examined.

All artificers generally do meaſure by a Table of ſquare numbers. And therefore if the body giuen to be meaſured, be ſquare, that is, if the thickneſſe and breadth bee equall, they can giue the iuſt content. But where theſe two dimenſions

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continually multiplyed between themſelues, ſhall be equal to 12, 12, & 12, continually multiplyed between themſelues. But 10, 14, and 12, doe giue for the product 1680. And 12, 12, and 12, as in former wee ſaw, gaue 1728. And the difference betweene 28, and 1680, is 48. Therefore the loſſe in euery foot of body, by their meaſure, is 48 inches.

vpon our Rular, you ſee 14 the parallell, to meet he beuelling line at 12 inches, and $\frac{12}{35}$ of an inch end of the Rular: And by multiplication you 10, 14, and 12 $\frac{12}{35}$ doe make 1728: Therefore our rule is true.

If the body giuen be 8 inches thicke, and 16 broad, they likewiſe take 4 from 16, and doe adde it vnto 8, and ſo, as afore, doe ſuppoſe it to be equall to 12 inches ſquare. Which, if it be true, then the product of 8, 16, and 12, ſhall bee equall to the product of 12, 12, and 12. But the product by the continuall multiplication of 8, 16, and 12, is but 1536: And the product of 12, 12, and 12, is 1728: and the difference betweene 1728, and 1536, is 192: Therefore by that their meaſure there is loſt in euery foot 192 inches. Now vpon the Rular we finde 8 and 16 to croſſe one another at $13\frac{1}{2}$: And

8,

8, 16, and 13 ½ continually multiplied one by another, doe giue the product 1728: Therefore this kinde of meaſuring by the Rular is exact.

If it were 6 inches thick, & 18 inches broad, by the ſame reaſon, euery 12 inches in length ſhould make a foot of ſolid meaſure. For the ſumme of all the ſides added together, is 48: And the quarter of 48 is 12: And their Table for the ſquare of 12, doth aſſigne 12 inches for the length. But 6, 18, and 12, multiplied continually doe make but 1296, which differeth from 1728 by 432. Therefore by this their meaſure, in euery foot of ſolid meaſure, there is loſt 432 ſolid inches. That is iuſt one quarter of a foot.

Vpon this our inſtrument 6, and 18, are obſerued to meet at 16 inches from the ſaid fore end: and therefore it alloweth for a foot 16 in length. And 6, 18, and 16 continually multiplied doe make 1728: therefore our rule is true.

Of the meaſuring of Plaines, or Land, Meddows, and Woods by the Aker.

Although this inſtrument, as the title ſpecifieth, bee fitted only for the meaſuring of Plains and Solids by the foot: Yet, as before is mentioned, it may eaſily bee applyed to other like ſort of meaſuring. Now, among others, there being none of more frequent vſe amongſt vs, then the Rod or Perch for the meaſuring of Land, Meddow, and Wood by the Aker: And this being either not eaſie to be done by the vnlearned; or not ſpeedily to be performed by any, I haue thought it not amiſſe, for the further declaratió of the vſe & excellency of this inuention, and for the benefit of others, to adde vnto the former, ſomething of this alſo.

doe differ, there by their rules they doe it not without ſome error. For to bring it to the vſe of their Table, they muſt firſt make the thickneſſe and breadth equall; which they doe, by taking the exceſſe from the greater, and adding of it to the leſſer, or, which is all one, by girding of the body about, and by taking of the quarter of the compaſſe. An example or two will make all plaine.

Suppoſe a body, giuen to bee meaſured, were 10 ynches, thick, and 14 broad. Here they take 2 from 14, and adde it vnto 10, and ſo doe make all the ſides equall: Or by girding of it they finde the compaſſe to be 48. And the quarter of 48 to be 12. And their table for the ſquare of 12 ynches, doth giue 12 ynches for the length required to make a foot of ſolid meaſure. If this be true, then 10, 14, and 12, continually multiplyed betweene themſelues, ſhall be equal to 12, 12, & 12, continually multiplyed between themſelues. But 10, 14, and 12, doe giue for the product 1680. And 12, 12, and 12, as in former wee ſaw, gaue 1728. And the difference betweene 28, and 1680, is 48. Therefore the loſſe in euery foot of body, by their meaſure, is 48 inches.

vpon our Rular, you ſee 14 the parallell, to meet he beuelling line at 12 inches, and $\frac{12}{35}$ of an inch end of the Rular: And by multiplication you 10, 14, and 12 $\frac{12}{35}$ doe make 1728: Therefore our rule is true.

If the body giuen be 8 inches thicke, and 16 broad, they likewiſe take 4 from 16, and doe adde it vnto 8, and ſo, as afore, doe ſuppoſe it to be equall to 12 inches ſquare. Which, if it be true, then the product of 8, 16, and 12, ſhall bee equall to the product of 12, 12, and 12. But the product by the continuall multiplication of 8, 16, and 12, is but 1536: And the product of 12, 12, and 12, is 1728: and the difference betweene 1728, and 1536, is 192: Therefore by that their meaſure there is loſt in euery foot 192 inches. Now vpon the Rular we finde 8 and 16 to croſſe one another at 13 $\frac{1}{2}$: And

8,

8, 16, and 13 ½ continually multiplied one by another, doe giue the product 1728: Therefore this kinde of meaſuring by the Rular is exact.

If it were 6 inches thick, & 18 inches broad, by the ſame reaſon, euery 12 inches in length ſhould make a foot of ſolid meaſure. For the ſumme of all the ſides added together, is 48: And the quarter of 48 is 12: And their Table for the ſquare of 12, doth aſſigne 12 inches for the length. But 6, 18, and 12, multiplied continually doe make but 1296, which differeth from 1728 by 432. Therefore by this their meaſure, in euery foot of ſolid meaſure, there is loſt 432 ſolid inches. That is iuſt one quarter of a foot.

Vpon this our inſtrument 6, and 18, are obſerued to meet at 16 inches from the ſaid fore end: and therefore it alloweth for a foot 16 in length. And 6, 18, and 16 continually multiplied doe make 1728: therefore our rule is true.

Of the meaſuring of Plaines, or Land, Meddows, and Woods by the Aker.

ALthough this inſtrument, as the title ſpecifieth, bee fitted only for the meaſuring of Plains and Solids by the foot: Yet, as before is mentioned, it may eaſily bee applyed to other like ſort of meaſuring. Now, among others, there being none of more frequent vſe amongſt vs, then the Rod or Perch for the meaſuring of Land, Meddow, and Wood by the Aker: And this being either not eaſie to be done by the vnlearned; or not ſpeedily to be performed by any, I haue thought it not amiſſe, for the further declaratiō of the vſe & excellency of this inuention, and for the benefit of others, to adde vnto the former, ſomething of this alſo.

An Aker of Land is, as before we heard, an oblong parallelogramme, whoſe breadth is 4 Poles, and length 40. Therefore an Aker conteineth 160 ſquare Rods, of what figure or forme ſoeuer it be. For 4 times 40, are 160. This here in this caſe is, as 144 was in Board, and 1728 was in ſolid meaſure, as it were the Standard, whereby this kinde of meaſure is to be examined.

Land, Meddow, or Wood, is to bee meaſured by this inſtrument, in all reſpects, as Board or Glaſſe was meaſured. Only two things are here firſt to be knowne: The firſt is, That as there the beuelling line of 12, was alwayes giuen for the breadth, as appropriate to that kinde of meaſure: So here another, peculiar to this manner of meaſure, is in like ſort to bee drawne ouerthwart the parallell lines from 6$\frac{2}{3}$ of an inch from the fore-end of the Rular, in the parallell 24, vnto 13 and $\frac{1}{3}$ in the parallell 12. The ſecond is, That as there lines and ſpaces did anſwer, and were denominated of inches and parts of inches; ſo here the ſame lines and ſpaces muſt bee ſuppoſed to ſignifie Rods and Perches, and parts of the ſame. An example or two will make all plaine and manifeſt.

1 Suppoſe a right angled ſquare field of 16 Pole broad, and 30 in length were to be meaſured: Here I finde 16, to meet with the line of Land meaſure at 10 inches from the fore end of the Rular: Therefore I ſay, that euery 10 rod in length, of the breadth of 16 rods, ſhall make an aker of Land. And againe, becauſe the ſaid 10 is found in 30 the length giuen 3 times: Therefore I ſay, the field aſſigned doth conteine 3 Akers.

2 A ſquare Meddow right-angled of 40 Poles in breadth, and 60 in length, is to be meaſured. Here 40, the leſſer number of the two giuen, is greater then any vpon the Rular: Therefore I take 20, the halfe of 40: And I finde 20 to meet with the line of land meaſure, at 8 inches from the ſaid fore-end of the Rular. Therefore firſt I ſay, That euery 8 Pole in length of the breadth of 40 Pole, ſhall conteine 2 Akers of

Meddow. Againe becauſe 8 is conteined in 60 ſeuen times and $\frac{1}{2}$: therefore I auerre, that the Meddow aſsigned to bee meaſured, doth conteine 7½ akers.

3 Admit that a Wood to bee meaſured were 160 rods ſquare: that is, that euery ſide of the ſame were 160 Poles in length. Here 160 is farre greater then any number vpon the Rular: Therefore I take 16, the tenth part of 160: which I obſerue to croſſe the line of land meaſure at 10 inches from the fore end of the Rular: wherefore firſt I affirme, that euery 10 pole of the breadth of 160 pole, ſhall conteine 10 Akers of Wood: Againe, becauſe 160 doth 10 ſixteene times, I ſay, that the Wood doth conteine 160 Akers. Or, which is all one, that euery Pole in breadth of that length, doth conteine an Aker.

But ſome man may obiect and ſay, this is not a matter worth the learning, or of ſo many words, ſeeing that it is well knowne, that there are many men wholly vnlearned, yea, and ſome of no extraordinary parts of capacity or vnderſtanding, which can meaſure Land, Meddow, or Woods, ſo that they be ſquare, or of any ordinary forme. I confeſſe I haue knowne diuers ſuch. And yet is not this our labour in vaine, or altogether vnprofitable: For firſt, what they doe with much ſtudy or contention of minde, and are long in doing of it, we teach to doe with great facility and ſpeed. For they, although the field be a rightangled parallelogramme, muſt firſt meaſure at the leaſt two ſides comprehending one or other of the rightangles. And then multiply theſe two ſides the one by the other: And laſtly, the product found, they muſt diuide by 160: And ſo by the quotient now found, anſwer the queſtion propounded. We ſaue a great deale of this labour. For we only meaſure the breadth of the field; then wee ſeeke vpon the Rular, how much in length of this breadth doth make an Aker. Laſtly, we apply this laſt number found vnto the whole length, and ſo without either multiplication or diuiſion, doe ſpeedily anſwere the demand.

¶ 3

Another thing there is wherein this inuention doth goe farre beyond the reach of the vnlearned, which is thus. Theſe men can ſooner meaſure and caſt vp the whole content of the field, then they can ſet you out one, two, or three Akers of the ſame. Here it is all one to giue the content of the whole, or any part, or parts of the ſame. And that which to thoſe is moſt hard, here to vs is moſt eaſie: I meane to ſet out any one or more Akers of the ſame; and that on which ſide or end of the field you ſhall thinke good.

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8 8 8 8

MESOLABIVM

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ARCHITECTONICVM

3 3 3 3 3 3

THAT IS,

A moſt rare, and ſingular Inſtrument, for
the eaſie, ſpeedy, and moſt certaine mea-
ſuring of Plaines and Solids
by [illegible] foote:

of great vſe to
meaſure Timber
Phillips. p. 196

Neceſſary to be knowne of all men whatſoeuer,
who would not in this caſe be notably
defrauded:

Inuented long ſince by *Mr. Thomas*
Bedwell Eſquire:

And now publiſhed, and the Vſe thereof decla-
red by *Wilhelm Bedwell*, his nephew,
Vicar of Tottenham.

LONDON,
Printed by *J. N.* for *VVilliam Garet*
1621.

1631

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TO THE ILLVSTRIOVS,

Right-honourable, Right-worſhipfull, and dearely beloued, the Nobility, Gentry, and Commons of *Great Britaine*, and *Ireland*.

God, ſayth the wiſe man, hath ordered all things by meaſure, number, and weight. And man, the image of God, ought, as the Philoſophers teach, to order all his life according to the ſame directions. And yet who knowth not, how little they are of all men regarded! To paſſe by the generall, and to come to that which concerneth our commerce, What ſmatterer in the Mathematicks is hee, who knoweth not, what neglect or ignorance there is, euen in thoſe artiſts, whom all men, the Rich aſwell as the Poore, do, and muſt daily truſt, in matters of meaſuring! I accuſe no man of wilfull fraude or malice. But this I ſay, There is no man whatſoeuer, that is not ſome peece of a ſcholler, that can meaſure tymber truely: And thoſe who are moſt skil-

full in both, cannot do it either ſpeedily, or readily. All which, Illuſtrious, Righthonourable, Right-worſhipfull, and Dearely beloued, I promiſe in this ſhort treatiſe, by the ordinary Inſtrument, in this caſe vſed, to teach the meaneſt of vnderſtanding, though wholy vnlearned, to do, with that ſpeede, facillity, and certainety, that may not be bettered. This as a prodromus, *begun and ended, in the middeſt of many and great troubles, I thought good to premiſe and ſend out, before a larger diſcourſe of the Fabricke, and more ample Vſe thereof, which, God willing, ſhall follow, ſo ſoone as Figures and Diagrammes may conueniently be cut, for that purpoſe, with all poſſible ſpeed: In the meane time the Author, wholy deuoted to his Countries ſeruice, reſteth*

Your H.H.H. in all obſeruancy,

Wilhelm Bedwell.

MESOLABIVM ARCHITECTONICVM.

CHAP. 1.

Of the Meſolabe: And of the vſe of it in generall.

1 To meaſure by this Rule, is by two knowne lines, to finde out the third vnknowne.

THe Inſtrument whoſe vſe at this time wee intend to declare, is no other, in reſpect of matter and forme, in generall, but the Carpentars rule, by them vſed in the meaſuring of Tymber, and Bourd by the Foot ſquare; For it is a flat Ruler, or oblong parallelogram, of two foote, or a foot & halfe long: Two inches and an halfe, or their abouts, broad: And of ſuch convenient thickneſſe as ſhall at euery mans diſcreſion be thought moſt fit.

Againe, as theirs, ſo this on the one ſide, contayneth a Scale of equall diuiſions, Firſt of Ynches, Halfe-ynches, Quarters, Halfe quarters, and ſo forth: Then againe, on the ſame ſide, you haue an Ynche diuided into Seauen, Eleuen, Thirteene, Seauenteene, Nineteene, and Three and twenty, and ſuch other equall parts, as euery man for his owne vſe ſhall think moſt fitte, and the workmans hand ſhall be able to performe.

More ouer, on the other ſide, as on theirs alſo, you haue a Scale of vnequall diuiſions, ſeruing for the meaſuring of Bourd and Tymber: But after a farre different manner: For their diuiſions are only markes or ſmall ſtrokes, in one of the limbs of that ſide, determinyng from the Fore-end of the Rular in ynches, and partes of ynches, the Square meaſure of ſolids or Tymber. Wheras this of ours conſiſteth of two ſortes of ſtraight lines, the one Beuelling or Slanting, drawne askue from ſide to ſide: The other Parallell that is equidiſtant one from another running along the Rular, from the one end toward the other: And therefore cutting thoſe former, and diuiding them into vnequall portions, whereby not onely their ſayd Quadrate or ſquare meaſure is performed: But alſo all other whatſoeuer, and that with great facillity, ſpeede, and certainety.

Laſtly here, as alſo there, you muſt make a diſtinction betweene end, and end; For that end we call the For-end of the Rular, from whence the diuiſions of it into ynches, on both ſides are begun to be reckoned: And that the Backer-end where they doe end and determine: Or, contrarywiſe, the For-end is that from whence the numbers aſcribed to the Beuelling linnes are leſſe and leſſe. But the diſtances betweene them are greater and greater.

Thus much of the Ruler, and the Partes therof. *Menſura, innuit Ariſtoteles, in quolibet menſurabili genere, eſt quippiam minimum*: A meaſure, as Ariſtotle ſeemeth to intimate, is ſome ſmall portion in euery thing that is to be meaſured: And it is commonly termed of the Geometricians *Famoſa menſura*: A knowne, or ſet meaſure generally agreed vpon amongſt all men: As in meaſuring by hand-breadths, feete, and paſſes, one hand breadth, on foot, one paſſe. And in deed it is an old ſaying of *Protagoras*, as Ariſtotle recordeth, *That man is the meaſure of all things*. And true it is, That Vitruuius, and Hero the mechanicke or inginer, do ſhew, That generally all meaſures are taken from the partes of Mans body, as a Finger, an Ynch (*Pollex*) an Hand, or Hands breadth, a Spanne, a Foot, a Cubite, a Paſſe, an Elne, a Fathome.

But who knoweth not, What great difference there is between man & man? And not only between men of diuerſe Countreys and climats: But eu'n between thoſe of one and the ſame prouince; Nay of one and the ſame family, children of the ſame parents? And, the limmes of men being proportionall to their bodys, what difference muſt there needs bee, betweene the meaſures taken from them? And in deed heerupon it came to paſſe, That the Meaſures, not only of diuerſe Nations: But eu'n of one and the ſame, are, and alwayes haue beene much different, as doth manifeſtly appeare by the diligent compariſons made of them by diuerſe and ſundry learned men, and eſpecially by that hopefull Willebrordus Snellius, as wee ſhall, God willing, ſhortly teach in Ramus's Geometry, which wee purpoſe to ſet out in Engliſh, for the benefite of ſuch of our Countrey men, as delight in theſe ſtudy's, yet are ignorant of thoſe languages where in they are written.

This difference was in this our kingdome complained of in all ages: For from hence aroſe many greeuous quarrells and ſuites in the Law, which our worthy Kings, and ſtate in their Parlaments, in all ages haue laboured to appeaſe, by reducing all to an vniformity: For thus wee finde in our Statutes: *It is ordeined, That 3 grains of* Barley, *dry and round, do make* an Ynche: *Twelue ynches do make* a Foot: *Three foote do make* a Yard: *Fiue yards and halfe do make* a Perch. *And 40 perches in length, and 4 in Breadth do make* an Aker. 33 of Edward the firſt, *De Terris menſurandis* Item, *De Compoſitione vlnarum et Perticarum.* Againe in a Perlament held in the 25th of Queene Elizabeth, you haue an Act, thus intituled: An Act for the reſtrainte of New-buildings, &c. in & nere the citys of London & Weſtminſter *Be it enacted by the authority afor'ſaid,* That a Mile *ſhall be taken & reckoned in this manner, & no otherwiſe:* That *is to ſay,* a Mile *to containe* 8 *Furlongs. And euery* Furlong *to containe* 40 *lugges or poales: And euery* Lugge *or* Poale, *to containe* 16 *foot and an halfe.*

Although this ſame our Rule may bee fitted for ſundry other ſortes of meaſures: Yet we haue here nothing to do, But with the Foote, and his partes, which are Ynches, Halfe-ynches, *Q*uarters, Half-quarters, and ſuch other ſenſible partes of the ſame.

2 Things to bee meaſured by this Rule, are magnitudes.

3 A magnitude is a continuall quantity.

A magintude, or a bigneſſe is that which hath one, or more dimenſions: Now dimenſions are in number three, to weet Length, Breadth, and Thickneſſe.

4 A magnitude is of one dimenſion, or many.

5 The meaſure is of the ſame nature with the thing to be meaſured.

6 A magnitude of one dimenſion is called a Line.

A line, is a magnitude of length onely. Or, A line is a magnitude onely long. Such are wayes, or diſtances betweene place and place. Such a magnitude, ſayth Proclus out of Apollonius, is conceiued in the meaſuring of iourneys. And by the difference of a lightſome place, from a darkſome. Such are Lenghts, Heighths, Depths, and Breadths. Therfore here

7 The meaſure vſed is a line.

Here therefore there is no further skill required in the meaſurer then a due application of the meaſure giuen: And therefore here in this caſe there is not any vſe of this our Inſtrument.

CHAP. II.

Of the meaſuring of Plaines by the foot ſquare.

1 A magnitude of many dimenſions, is of two or three: That is called a Surface: This a Solid.

2 If a dimenſion giuen, be eyther greater, or leſſer, then any of the numbers vpon the Rular, you muſt take ſome leſſer, or greater,

which is proportionall vnto it.

3 A ſurface is a magnitude long and broad.

That is, a ſurface is a magnitude which hath two dimenſions, to weet Length and Breadth. Such magnitudes, ſayth Apollonius, are the ſhadowes vpon the ground, which ouerſpread the fields farre and wide, but do not enter into, or pierce the earth: Neither haue they any thicknes at all. The Greek woord *Epiphania*, is here more ſignificant. For this worde intimateth no more but, The outward appearance of any thing. For of a magnitude nothing is to be ſeene but the ſurface. Such are bourds eſteemed to be by the Carpentars: Wainſcotte, by the Ioyners: Glaſſe, by the Glaſiers: Cloth, both linnen & Woollen, by the Drapers: Land, Medowe, & Wood, by the Surueighers: For in the meaſuring of theſe, there is only Breadth & Length conſidered, with out any reſpect at all had to the Thickneſſe.

Witte
Sphæra
(74

Therfore

2 Here the meaſure is a Surface.

Surfaces, according to their diuerſe natures, are meaſured with diuerſe and ſundry kindes of meaſures: Wood, Land, & Medowe, are meaſured by the Rod or Perch: Cloth, Painting, Pauing, & Wainſcotte, by the Yard: Bourd and Stone, by the Foote. Although this our Inſtrument may be fitted to all theſe, or any other like meaſure, Yet wee at this time intend to meddle with no other but the laſt, to weet With the Footeſquare.

4 A ſurface is either Plaine or Vneu'n.

5 A Plaine ſurface is a ſurface, which lyeth equally between his bounds.

A ſurface, the learned knowe is geometrically made of Lines: Therfore as lines are either ſtraight or Crooked: So from hence are all ſurfaces Straight or Crooked: Or, to ſpeak more properly, Eu'n or vneu'n, Plaine or Rugged: Yea & by a ſtraight line are ſurfaces tried, whether they be Eu'n, or vneu'n. For if a right line applyed to a ſurface euery way, do touch it in all places, it is Eu'n: Otherwiſe, it is vneu'n.

9 Plaines, as wee ſayd, are meaſured by the Foote ſquare, That is the quadrate of 12 ynches.

A foote of plaine or flatte meaſure is the quadrate of 12 ynches, or that which is equall vnto it. That is, it containeth 144 ſquare Ynches: For 12 times 12, are 144. Hauing therefore a plaine giuen of 12 ynches broad, there is no queſtion but 12 ynches of that breadth ſhall make a Foote. But if the breadth giuen be greater or leſſe then 12, there is a queſtion, What length, with the breadth giuen, ſhall make a plaine equall to the ſquare 144. Here

7 Of the two lines giuen, the one is the breadth aſſigned, the other is alwayes the beuelling line 12.

Here againe it muſt bee remembred, *That onely thoſe plaines are to be meaſured which are Rightangled parallelogramms*, Or to ſpeake in their owne Language, which are comprehended of a, Baſe, and Heigh which are rationall betweene themſelues: Ramus 9 e 1 I I I. Thoſe plains therfore which are not ſuch, muſt bee reduced vnto theſe kinde of figures.

Element

1 An example or two ſhall make all plaine. A bourd of 16 ynches broad and 18 ynches long, (And ſo a ſtocke of 13 bourds) is to be meaſured. Here I finde 16, the line anſwering to the Bredth, to croſſe the beueller 12, at 9 ynches from the fore-end of the Rular. Therefore I ſay euery 9 ynches of that length ſhall make a Foot of bourd: Or which is all one, ſhall be equall to 144, the ſquare of 12 ynches. Now 9 ynches I finde to bee contained in [illegible] foote, the Length, 24 times: Therefore I ſay, The bourd aſſigned doth containe 24 foote of bourd. Laſtly, there being in the ſtocke 13 ſuch bourds, I ſay the whole ſtocke doth contayne 312 foot of bourd.

II A Table of 36 ynches broad, and 28 foote long, is to be meaſured. Here 36 is greater then any of the parallels found vpon the Rular: Therefore by the 2 e of this, I take 18 the halfe of it, which I finde to meete with 12, the beueling line, at 8 ynches from the for'end of the Rular: Therefore euery 8 ynches of length, of the bredth 18, ſhall contayne a foote of bourd: But the breadth giuen is 36 ynches: That is twice 18: Therefore euery 8 ynches in length, of that Table ſhall be 2 foote of bourd. Now againe I finde 8 ynches, in 28 foote 42 times: Therefore the Table containeth twice ſo many foot: That is 84 foote of bourd.

III A pane of Glaſſe, 7 ynches broad, is to bee meaſured. Here 7 is leſſer then any of the parallels: Therefore by the 2 e of this, I take 14, the double thereof: Which I obſerue to meete with 12, at 10 ynches and 2 ſeauenth parts of an ynch from the fore-end: Therefore euery 10 ynches and 2 ſeauenth partes of an ynch, of 14 ynches breadth, ſhall bee a foote of Glaſſe: But the breadth giuen is but 7 ynches: Therefore euery 10 ynches, and 2 ſeauenth partes of an ynch ſhall be but halfe a foote of glaſſe.

Of the meaſuring of Triangles, and all other Rightlined plaines.

8 A triangle is nothing elſe but the halfe of a quadrangle, or parallelogramme: And if it haue one right angle, it is the halfe of a rightangled parallelgramme. *Therefore*

9 It is to bee meaſured as the Rightangled-parallelogramme, onely conceiue that the number found, ſhall bee the double of that which is ſought.

Here therefore it muſt bee conceiued, That of the two ſides encluding the Rightangle, the one is to be vnderſtood to be the Breadth, the other the Length.

I Suppoſe a Rightangled-triangle, whoſe ſides including the Right-angle, are 18, and 24, are to bee meaſured. Here I take 18 for the Heighth, or Breadth of the parallelogramme. which alſo I finde to meete with the beuelling line 12, preciſly at 6 ynches from the fore end of the Ruler: Againe 6, the ſayd line found, I finde iuſt 4 times in 24 the Lenghth giuen: Therfore I auerre the Triangle giuen to conteine the halfe of 4 foote, that is 2 foote of bourd.

20 If the triangle giuen bee not right-angled, then is it by a perpendicular, let fall within the triangle, from one of the corners vnto the baſe, to bee reduced vnto two rightangled triangles.

How this is to be done, *Euclide* teacheth at the 11 & 12 propoſitions of his I, booke; And P. Ramus, at the 9 & 10 elements of his V. booke of Geometry. It is alſo to bee done by the ſquire. Or by a ttiangles leuell, and otherwiſe.

11 An Obtuſangled triangle, whoſe three ſides are 26 40, and 42, is to bee meaſured. Heere by one of thoſe aboue named wayes, I finde the perpendicular or plumbline, falling from the greater corner, vnto the oppoſite line, to be 24. And 24 I finde vpon the Ruler to meete with the line of 12, at 6 ynches from the fore-end of the ſame: Againe 6 I find it in 42 ſeauen times: Therefore the Triangle giuen doth conteine halfe ſo many foote, That is 3 foote and an halfe of bourd.

11 From hence it is manifeſt how any Rhombus, Rhomboides, Trapezium, or irregular rightlined multangles are to bee meaſured.

To weet, that they are to be meaſured by parts, or by the particular triangles, which euery ſuch figure doth contayne, Examples you may haue in the XIIII booke of Ramus's Geometry, or in any others, which haue written of Geometry.

Of the meaſuring of any ordinate multangle figured.

12 Ordinate multangled plaines are meaſured

by their halfe Perimeter, and the plumbline from the center, vnto the middeſt of any one ſide.

Theſe ſortes of plaines may bee meaſured, as the former were, by diuiding them into their ſeuerall Triangles: But this laſt is farre ſhorter: And therefore to bee embraced & rather to be vſed in practiſe. Here the halfe of the perimeter, or bout-line, anſwereth to the Length in a parallelogramme: And the plumbline here, is in ſtead of the Heighth or Breadth there.

1 An ordinate Pentangle, whoſe ſides are 24 ynches a piece; And the Plumbline from the center, to the middeſt of any one of the ſides 16, is to be meaſured. Here 16 the Plumbline or Heighth, doth, vpon the Rular, meet with the ſlanting line 12, at 9 ynches from the oft named end: And 9 is contayned in 60, the halfe of the perimeter, 6 times and two thirds: Therefore the Pentangle giuen conteineth x 6 foot, and two third partes of a foot of Bourd.

6 2/3 ffeet makes
Inches; but ye
Area is 991
60) that is
and [illegible] 7/8.

II A Sexangled ordinate figure, whoſe ſides are 12 ynches broad a piece, is to bee meaſured. Here the Plumbline from the center to the middeſt of any one ſide, is 10 ynches, and 8 one and twentyths of an ynch: The double of 10 (that is 20.) and 6 one & twenty parts of one ynche, I obſerue to meete with the beueller 12, about 7 ynches, & one quarter of an ynch, from the fore end of the Rular. Which 7 and a quarter, is contained in 44 ſix time, and two twenty=nineth partes. Therfore I ſay the Sexangled figure giuen doth containe 6 foote of bourd, and ſome ſmall quantity more. The Circle, or Circular forme is in like manner meaſured: For

6 ffeet makes 8
ches, but ye e
Area is not
much ab
2 1/2 ffe
quare ye c
of this diff

13 The Circle is meaſured by the Ray, and the halfe of the perimeter.

For, ſayth the Geometrician; xx *Planus e radio & peripheria dimidio eſt area circuli.* The plaine of the ray, and halfe of the circumference is the content of the circle. A Round table, whoſe diameter is 4 foote, and 8 ynches, (or 56 ynches) is to

xx Ramus (2)

be meaſured. The halfe of ~~59~~ 56 is 28: And the halfe of the circumference is 88. Now 28 being geater then any of the paralells, I take 14 the half therof: Which I find to meet with the beuelling line 12, at 10 ynches, and a quarter, from the for'end of the Rular: Therfore I ſay euery 10 ynches, and a quarter of an ynche of that Table ſhall be 2 foot of bourd. And becauſe 88 doth containe 10 and 1 quarter, 8 times, and 20 fourty ones; Therefore I ſay, the whole doth containe × 16 foot of of bourd, and 144 ynches.

t e ~~144~~ inches
17 ffoot iust.
much oscitancy
x presse it thus: and
tinke the exact Area
Semid. be 28. and
Semicirc. 88. is 17 $\frac{11}{100}$ ffoot.

CHAP. III.

Of the meaſuring of Bodies or Solids by the Foot.

1 A Body is a magnitude of three dimenſions. A Body or Solid is a magnitude which hath Length, Breadth, and Thicknes.

2 Here the meaſure is alſo a body, to weet the Cube of 12 that is 1728.

This is our opinion: Yet if any ſhall thinke it a paradox, or ſhall gaine ſay it, or mainetaine the contrary, wee will not contend.

And 3 Of the three dimenſions, two are giuen, the third is ſought.

4 Bodies are of diverſe ſorts: But we will at this time meddle only with ſuch as are comprehended of parallelogrammes, or with Cylinders.

True it is, that this our inſtrument may bee fitted, and applyed to the meaſuring of many other ſorts of Solid bodies: But becauſe we ſee no great vſe of it in the meaſuring of any other, then of theſe two ſorts: Therefore wee will declare the vſe of it, in the meaſuring of theſe two onely. Of theſe the firſt is the Parallelepipedum, which is a plaine Solid, whoſe oppoſite ſides are parallelogramme.

I A rightangled parallelepipedum (or a ſquared tymber logge) of 12 Ynches thicke, 18 broad, and 16 foote long, is to be meaſured. Here the Thickneſſe and Breadth are giuen: The Length is ſought. Theſe I finde vpon the Rular to meet at 8 ynches from the oft named fore-end: Therfore I Say, Euery 8 ynches of that Logge in length ſhall make a ſolid foote of tymber. And becauſe I finde 8 Ynches, in 16 foote, 24 times: Therfore I ſay in the Tymberſticke giuen, there is 24 foote of ſolid meaſure.

Phillips

II A ſquared ſtone of 14 Ynches thicke, fiue foote (or 60 ynches) broad, and 10 foote long, is to be meaſured. Here 60 is greater then any of the parallels vpon the Rular: Therfore I take 12 the 5th part of it: And I obſerue 12 and 14, to meete at 10 ynches, and 2 ſeaunth partes of an ynche, from the Fore-end of the Rular. Therfore I ſay, That euery 10 ynches, and 2 ſeaunth partes of an ynch in length of that ſtone ſhall be 5 foote of ſolid meaſure. And becauſe that 10 foote conteineth 10 ynches, and 2 ſeaunth parts of an ynche, 11 times and 5 ſeau'nty twoos: Therfore I ſay the whole ſtone conteineth 58 foote, and one third parte of a Foote of ſolid meaſure.

III A rightangled Priſma, both whoſe ſids, Parallelogramm's I meane, conteyning the rightangle, are 18 ynches broad; the whole being in length 16 foot, is to be meaſured. Here vnderſtand that, as before was ſhewed, as a Triangle was but the halfe of a quadrangle: So a Priſma is nought but the halfe of a Parallelepipedum, ſawne longways from corner to corner though the midd'ſt: And hence in Greek it hath the name: This knowne I enter with the numbers giu'n, and I finde 18 to meet with 18, at 5 ynches and one third parte of an ynche from the oft named end of the Rular: Therefore I ſay, That euery 5 ynches, and 1 third parte of an ynche in length of that ſticke ſhall be but halfe a foote of ſolid meaſure. Nowe becauſe 5 ynches and 1 third of an ynche is conteined in 16 foote, 67 tymes and 14 ſixteen partes, that is almoſt 68 times: The ſore I ſay, The Priſma giu'n doth conteine almoſt 68 halfe foot's, or 34 foote of ſolid meaſure.

IIII A ſiſpaned ſolid, all whole ſides are 6 ynches broad a peece and 16 foote long, is to bee meaſured. Here the two lines giuen are, as aboue was taught, the Plumbline from the center, vnto the middeſt of any one of the ſides: And the halfe of the compaſſe; That, as before was taught, is 5 ynches, and 2 eleuenth partes of an ynche; This is, as you ſee 18. Now 5 and 2 eleu'nths doth meet with 18, at 19 ynches and 1 fifth parte of an inche from the fore-end: Therfore I ſay, That euery 19 ynches, and one fifth parte of an ynch, ſhall be a foote of ſolid meaſure. Laſtly, becauſe 16 ynches, and 1 fifth parte is conteined in 16 foot, 10 times, and 2 fifteene pates, I ſay that the tymber ſticke giu'n doth containe 10 foot of ſolid meaſure, and ſome ſmall quantity more.

Laſtly a Round columne, or Cylinder, of 44 ynches about, & 12 foote long, is to be meaſured. Here according to that aboue taught, the two lines giu'n are, The half diameter, & the halfe circumference: This is 22: That 7. Now theſe two do meete vpon the Rular at 11 ynches, and 17 ſeauenty two partes, of an ynch, from the fore-end there of; Therefore the ſticke containeth about 13 foot of tymber or ſolid meaſure.

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